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CLEANSING NEW YORK HARBOR

By SIDNEY A. REEVE

For many years the pollution of the water of New York harbor has been very bad. The ejection of the city's sewage into the North and East Rivers, combined with some carelessness as to dead animals and some infraction of the law by the manufacturing industries, has led to a situation which is nothing short of a disgrace for the first city of America.

Within the last few years conditions have been made considerably worse by the transformation of many large ships from coal to oil burners. Heavy scums of waste oil have coated the water and even the river shores as far north of the city as the flood tide sets in and all of the beaches below the city inside of Norton's Point and Sandy Hook. The presence of this oil upon the water has led to at least one serious fire.

Meanwhile New York has advanced in rank from the first city in America to the first city in the world in financial importance if not in population. It is the port of entry for world travel towards the greatest of all world centers. That its harbor should be as dirty as it now is, has become a national disgrace.

The cleansing of the harbor has for some time been a matter of concern to several of our prominent citizens. The only outcome of their efforts, however, has been an attempt at better enforcement of existing laws. Since even a perfect enforcement of the laws would still leave the harbor polluted with sewage, which is really the worst of the features mentioned if not the one most offensive to the eye, it is worth while to consider whether measures might not be taken which would rid us of all sorts of pollution at once. For this could be accomplished by rinsing out the harbor twice a day with clean sea water, by tidal action controlled by suitable tidal gates.

NATURAL CLEANSING EFFECT OF THE TIDES

In order that this possibility may be clear to the reader, reference should be made to the outline map of New York harbor and neighboring waters, Figure 1. The map shows the waters immediately surrounding Manhattan Island to be accessible to tidal action from the sea in two directions, namely: (1) from the south, through the Narrows, and (2) from the east, through Long Island Sound and Hell Gate. The tides entering by these two routes do so fairly simultaneously, giving rise to the tidal phenomena in the East River, as a result of which somewhat more water flows in a southwestwardly direction through Hell Gate, on the ebb, than passes in in the northeasterly direction on the flood. The slight difference in the time and force of the two tides results in the draining, on the ebb, of a small portion of the clean

sea water which had been sent in through Long Island Sound on the flood, out through the East, Harlem, and Hudson Rivers and thus out to sea through the Narrows.

At present this slight rinsing action is the only factor tending to cleanse New York Harbor of its pollution at all; for the amount of fresh water

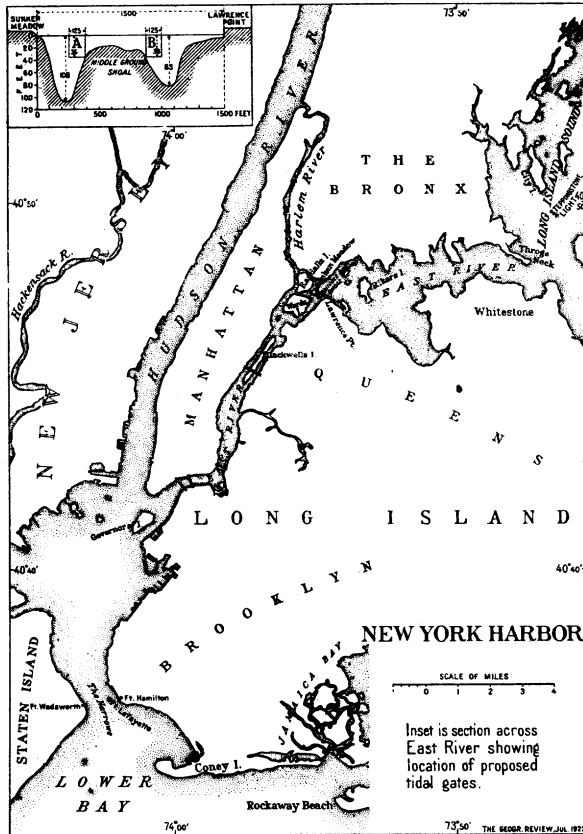


FIG. 1—Outline map of New York harbor and neighboring waters to illustrate the proposal to erect tidal gates across East River as shown in the inset section. The vertical scale of the section is five times the horizontal scale.

coming down through the Hudson is insignificant in comparison with the size of the estuary and is quite inadequate for the dilution of the city's sewage to an appreciable degree. Yet if this slight degree of cleansing did not occur, the waters of the harbor would long ago have become so foul as to be intolerable.

INCREASING THE CLEANSING ACTION BY TIDAL GATES

The object of the present paper is to point out the fact that the natural cleansing action of the tides might be multiplied manifold by the erection

of tidal gates in East River at some point near Wards Island. Such gates are supposed to be operated by power, automatically set into action by the turn of the tidal current, in such manner that on the eastward flow of the tide through Hell Gate they are closed, while during the westward flow they stand open. The gates would involve a problem that is not serious either from the engineering or the financial point of view, in comparison with the magnitude of the interests concerned.

Supposing such gates to be in position and operation, their closure during the flood tide would force all of that area of waterway between Wards Island and Throgs Neck, or perhaps even as far as City Island, to fill with fresh sea water from Long Island Sound instead of filling with polluted harbor water through Hell Gate, as is now the case. When the tide turned for ebb, the opening of the gates would permit the bulk of this surplus clean sea water to escape to sea through New York Harbor, instead of returning eastwardly into Long Island Sound, as it does now.

Twice every day this process would put, on the average, about ten billion gallons of pure sea water into and through New York harbor, washing out to sea through the Narrows its accumulation of impurities. The actual amount would vary from day to day, according to moon and weather; but the average amount would be about that stated—ample for rinsing out the harbor to a state of virtual cleanliness.

Since immediate objection will be made that such pollution is not wanted in the waters below the Narrows, it is to be replied that *it all goes there now, anyhow*. There is at present no appreciable efflux of sewage or other pollution into Long Island Sound. It all goes out through the Narrows, polluting the adjacent beaches before it finally dissolves in the sea. The trouble at present is that the local pollution becomes very much concentrated before it is washed out to sea. That is to say, the beaches below the Narrows, as well as the wharves in the city and both banks of the Hudson to and above Yonkers, are now washed by a relatively stationary quantity of highly polluted water.

Under the suggested plan, on the other hand, this same amount of pollution—no more and no less—would pass through the Narrows; but in the proposed situation it would be diluted, say tenfold more than it is at present. For this reason the bulk of it would flow past the adjacent shores into deep water without finding opportunity for the deposit of sediment upon the beaches; whereas now the polluted water drifts sluggishly back and forth until the wind has had time to deposit most of its burden upon the shore.

RELATION TO NAVIGATION

Since a second obvious objection to the procedure suggested lies in its interference with navigation, the inset figure is added, showing in profile the cross-sectional area of East River at a possible point for the tidal gates, namely, opposite Sunken Meadow, across Middle Ground Shoal. At this

point the channel is split in two by the Shoal, leaving a waterway 83 feet deep at mean low water to the east of the Shoal and one 108 feet deep to the west of the Shoal. This is the deepest spot in the Harbor north of the Narrows.

The inset shows how this depth conduces to the operation of the supposed tidal gates, even if gateways for navigation have to be left open during the daylight flood tide. Such ship gateways are shown at *A* for the western channel and at *B* for the eastern channel, each gateway being 125 feet wide by 36 feet deep. The profile shows that even if waterways of this size had to be left open, there would still remain a closure of the greater portion of the area available for tidal flow. This is all that is necessary. Furthermore, when the flood tide occurred during the later hours of the night this leakage due to navigation could be avoided by closing the entire area of waterway.

So great is the demand of the Flushing Bay district for sea water during the flood tide, that the latter sets in from the southward not only past Blackwells Island, but also through the circuitous path around Manhattan Island—up the Hudson River, through the Ship Canal, and then southwardly through the Harlem River. Even with this additional water supply the rate of tidal flow past Wards Island is from 2 to $3\frac{1}{2}$ knots. This strong current shows how powerful would be the cleansing action, provided this flow were shut off during one tide, so as to set back in the form of clean sea water during the ebb. Then the effluent clean sea water would flow not only down East River, but also up the Harlem and into the Hudson at Spuyten Duyvil, purifying that beautiful estuary well above Yonkers.

In order to shut off this flow through the Harlem River also, on the flood tide, smaller tidal gates would have to be installed between the Sunken Meadows and Randalls Island, and also between Randalls Island and the mainland. These two channels, however, are not only small and shallow but are of no importance to navigation and hence could always be closed on the flood tide.

No estimate has been made of the cost of such tidal works, but it is obvious that it would be slight in comparison with the object sought.